Mediterranean Crustal Motions: Numerical Models Constrained by Geologic and Space Geodetic Data

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The Mediterranean is a region of complex crustal deformat ion bet ween Eurasia to the north and Africa and Arabia to the south. Principally a collision zone comprising the western half of the Alpine-Himalayan orogen, it includes a number of rotating blocks and microplates and varying tectonics including subduction, extension and rifting, collisional mountain belts, and shear zones. Aspects of Mediterranean crustal deformation arc well understood (e.g., tectonic escape of the Anatolian Block), but other features arc less clear' such as the rapid retreat of the Hellenic arc (-4 cm/yr) compared to the ovc.rail convergence rates and the much slower' escape of Anatolia. Recently, space geodetic (VLBI, S 1 .R, and GPS) studies have begun to provide stron g constr aints on cr ustal motion throughout region, although the spatial sampling of this data is heterogeneous and concentrated in Greece and Turkey. Wc have studied the distribution of Mediterancan crustal motions using a 2-D spherical elastic shell finite element technique constrained by geologic data in the form of fault (slip sense and rate) and space. geodetic (baseline rates of change) data. Faults are introduced as free shear or split nodes constrained in rate and direction, direction, or left completely unconstrained. Geodetic baselines are modeled as telescoping, articulating truss bars which connect to the mesh at their end points. Stable Africa and Arabia arc modeled as rotat ing shells forced at thei r boundaries by their NUVEL- IA velocities relative to fixed Eurasia. Preliminary models with only geologic constraints produce the expected rotation of Anatolia, extension in the Hellenic backarc, and compression along the Calabrian arc. If Adriatic crust is connected to Africa, the model requires significant slowing from 7 mm/yr south of Puglia to 1-? mm/yr in the Adriatic. Combined geologic and geodetic models will refine these preliminary results and allow us to produce a model of crustal and fault motions from the Mid-Atlantic to the Caspian Sea.

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